

Claims

- [c1] 1. An automotive headlamp comprising a housing for receiving a light source and an outer lens disposed such that light from a light source disposed in the housing passes through the lens, wherein the lens comprises a polycarbonate and a photoluminescent material and is compliant with SAE standards for automotive headlamps and provides a visual effect at least at an edge of the lens as a result of photoluminescence from the photoluminescent material.
- [c2] 2. The headlamp of claim 1, wherein the photoluminescent material is an organic fluorescent dye.
- [c3] 3. The headlamp of claim 2, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c4] 4. The headlamp of claim 3, wherein the fluorescent dye provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.
- [c5] 5. The headlamp of claim 4, wherein the fluorescent dye is included at a concentration of 0.3 to 0.1% by weight.
- [c6] 6. The headlamp of claim 4, wherein the fluorescent dye is included at a concentration of 0.1% to 0.005% by weight.
- [c7] 7. The headlamp of claim 3, wherein the fluorescent dye provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.
- [c8] 8. The headlamp of claim 7, wherein the fluorescent dye is included at a concentration of 0.0001% to 0.0003% by weight.
- [c9] 9. The headlamp of claim 2, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.

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- [c10] 10. The headlamp of claim 9, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c11] 11. The headlamp of claim 2, wherein the lens has one or more rib lines molded in the exterior surface thereof.
- [c12] 12. The headlamp of claim 11, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c13] 13. The headlamp of claim 10, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c14] 14. The headlamp of claim 2, wherein the fluorescent dye has a quantum yield of 0.7 or greater.
- [c15] 15. The headlamp of claim 14, wherein the fluorescent dye has a quantum yield of 0.9 or greater.
- [c16] 16. The headlamp of claim 1, wherein the exterior surfaces of the lens are coated with a UV-protective coating.
- [c17] 17. The headlamp of claim 16, wherein the photoluminescent material is an organic fluorescent dye.
- [c18] 18. The headlamp of claim 17, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c19] 19. The headlamp of claim 18, wherein the fluorescent dye provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.
- [c20] 20. The headlamp of claim 19, wherein the fluorescent dye is included at a concentration of 0.3 to 0.1% by weight.
- [c21] 21. The headlamp of claim 19, wherein the fluorescent dye is included at a

concentration of 0.1 to 0.005% by weight.

- [c22] 22. The headlamp of claim 18, wherein the fluorescent dye provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.
- [c23] 23. The headlamp of claim 22, wherein the fluorescent dye is included at a concentration of 0.0001% to 0.0003% by weight.
- [c24] 24. The headlamp of claim 17, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c25] 25. The headlamp of claim 24, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c26] 26. The headlamp of claim 17, wherein the lens has one or more rib lines molded in the exterior surface thereof.
- [c27] 27. The headlamp of claim 26, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c28] 28. The headlamp of claim 26, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c29] 29. The headlamp of claim 17, wherein the fluorescent dye has a quantum yield of 0.7 or greater.
- [c30] 30. The headlamp of claim 29, wherein the fluorescent dye has a quantum yield of 0.9 or greater.
- [c31] 31. The headlamp of claim 1, further comprising a bezel disposed between the lens and the housing.



- [c32] 32. The headlamp of claim 31, wherein the bezel comprises a polycarbonate and an photoluminescent material which may be the same as or different from the photoluminescent dye in the lens.
- [c33] 33. The headlamp of claim 32, wherein the photoluminescent dye in the bezel produces a visual effect of a different color from the photoluminescent dye in the lens.
- [c34] 34.The headlamp of claim 33, wherein the photoluminescent material included in the bezel is an organic fluorescent dye.
- [c35] 35. The headlamp of claim 34, wherein the fluorescent dye included in the bezel is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c36] 36. The headlamp of claim 35, wherein the fluorescent dye in the bezel provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.
- [c37] 37. The headlamp of claim 36, wherein the fluorescent dye in the bezel is included at a concentration of 0.3 to 0.1% by weight.
- [c38] 38. The headlamp of claim 36, wherein the fluorescent dye in the bezel is included at a concentration of 0.1 to 0.005% by weight.
- [c39] 39. The headlamp of claim 35, wherein the fluorescent dye in the bezel provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.
- [c40] 40. The headlamp of claim 39, wherein the fluorescent dye in the bezel is included at a concentration of 0.0001% to 0.0003% by weight.
- [c41] 41. The headlamp of claim 34, wherein the fluorescent dye in the bezel is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c42] 42. The headlamp of claim 41, wherein the fluorescent dye in the bezel is

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included at a concentration of 1 % or less by weight of the polycarbonate.

[c43] 43. An automotive headlamp comprising a housing for receiving a light source, a bezel and an outer lens disposed such that light from a light source disposed in the housing passes through the bezel and the lens, wherein the bezel comprises a polycarbonate and an photoluminescent material and headlamp is compliant with SAE standards for automotive headlamps, and wherein the bezel provides a visual effect at least at an edge of the bezel as a result of photoluminescence from the photoluminescent material.

[c44] 44. The headlamp of claim 43, wherein the photoluminescent material is an organic fluorescent dye.

[c45] 45. The headlamp of claim 44, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.

[c46] 46. The headlamp of claim 45, wherein the fluorescent dye provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.

[c47] 47. The headlamp of claim 46, wherein the fluorescent dye is included at a concentration of 0.3 to 0.1% by weight.

[c48] 48. The headlamp of claim 46, wherein the fluorescent dye is included at a concentration of 0.1 to 0.005% by weight.

[c49] 49. The headlamp of claim 45, wherein the fluorescent dye provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.

[c50] 50. The headlamp of claim 49, wherein the fluorescent dye is included at a concentration of 0.0001% to 0.0003% by weight.

[c51] 51. The headlamp of claim 44, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-

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benzoxazolyl]thiophene) and derivatives thereof.

- [c52] 52. The headlamp of claim 51, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c53] 53. The headlamp of claim 44, wherein the fluorescent dye has a quantum yield of 0.7 or greater.
- [c54] 54. The headlamp of claim 53, wherein the fluorescent dye has a quantum yield of 0.9 or greater.
- [c55] 55. The headlamp of claim 1, wherein the photoluminescent material is an organic nano-particle.
- [c56] 56. The headlamp of claim 55, wherein the organic nano-particle comprises a fluorescent dye selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, or (2,5-bis[5-tert-butyl-2-benzoxazolyl]-thiophene) and all their derivatives.
- [c57] 57. The headlamp of claim 1, wherein the photoluminescent material is an inorganic nano-particle.
- [c58] 58. A lens comprising a molded body having a generally concave outer surface, a generally flat or convex inner surface and an edge surface, wherein the molded body is formed from a composition comprising polycarbonate and an photoluminescent material, and wherein white light transmitted through the lens results in emission from the fluorescent dye which is conducted to a substantial extent to the edge surface of the lens thereby creating a colored visual effect at the edge of the lens.
- [c59] 59. The lens of claim 58, wherein the photoluminescent material is an organic fluorescent dye.
- [c60] 60. The lens of claim 59, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.

- [c61] 61. The lens of claim 59, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c62] 62. The lens of claim 61, wherein the fluorescent dye is included at a concentration of 1% or less by weight of the polycarbonate.
- [c63] 63. The lens of claim 61, wherein the fluorescent dye in the bezel provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.
- [c64] 64. The lens of claim 63, wherein the fluorescent dye in the bezel is included at a concentration of 0.3 to 0.1% by weight.
- [c65] 65. The lens of claim 63, wherein the fluorescent dye in the bezel is included at a concentration of 0.1 to 0.005% by weight.
- [c66] 66. The lens of claim 59, wherein the fluorescent dye in the bezel provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.
- [c67] 67. The lens of claim 66, wherein the fluorescent dye in the bezel is included at a concentration of 0.0001% to 0.0003% by weight.
- [c68] 68. The lens of claim 59, wherein the lens has one or more rib lines molded in the exterior surface thereof.
- [c69] 69. The lens of claim 68, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c70] 70. The lens of claim 68, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.

- [c71] 71. The lens of claim 59, wherein the lens is compliant with SAE standards for automotive headlamps.
- [c72] 72. The lens of claim 59, wherein the lens has an UV-protective coating on the outer surface and the edge surface.
- [c73] 73. The lens of claim 59, wherein the lens has an UV-protective coating on the inner and outer surfaces and the edge surface.
- [c74] 74. The lens of claim 58, wherein the photoluminescent material is an organic nanoparticle.
- [c75] 75. The lens of claim 74, wherein the organic nano-particle comprises a fluorescent dye selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, or (2,5-bis[5-tert-butyl-2-benzoxazolyl]-thiophene) and all their derivatives.
- [c76] 76. The headlamp of claim 58, wherein the photoluminescent material is an inorganic nano-particle.
- [c77] 77. A bezel comprising an annular molded body having a generally concave outer surface, a generally flat or convex inner surface and inner and outer edge surfaces, wherein the molded body is formed from a composition comprising polycarbonate and an photoluminescent material, and wherein white light transmitted through the bezel results in emission from the fluorescent dye which is conducted to a substantial extent to the edge surfaces of the bezel thereby creating a colored visual effect at the edges of the bezel.
- [c78] 78. The bezel of claim 77, wherein the photoluminescent material is an organic fluorescent dye.
- [c79] 79. The bezel of claim 78, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c80] 80. The bezel of claim 78, wherein the fluorescent dye is selected from the

group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.

- [c81] 81. The bezel of claim 80, wherein the fluorescent dye is included at a concentration of 1% or less by weight of the polycarbonate.
- [c82] 82. The bezel of claim 78, wherein the fluorescent dye in the bezel provides a blue or violet visual effect and the fluorescent dye is included at a concentration of 0.5 to 0.001% by weight.
- [c83] 83. The bezel of claim 82, wherein the fluorescent dye in the bezel is included at a concentration of 0.3 to 0.1% by weight.
- [c84] 84. The bezel of claim 76, wherein the fluorescent dye in the bezel is included at a concentration of 0.1 to 0.005% by weight.
- [c85] 85. The bezel of claim 78, wherein the fluorescent dye in the bezel provides a red, orange or green visual effect and the fluorescent dye is included at a concentration of less than 0.0005% by weight.
- [c86] 86. The bezel of claim 85, wherein the fluorescent dye in the bezel is included at a concentration of 0.0001% to 0.0003% by weight.
- [c87] 87. The bezel of claim 78, wherein the bezel has one or more rib lines molded in the exterior surface thereof.
- [c88] 88. The bezel of claim 87, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphtalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c89] 89. The bezel of claim 88, wherein the fluorescent dye is included at a concentration of 1 % or less by weight of the polycarbonate.
- [c90] 90. The bezel of claim 78, wherein the bezel is compliant with SAE standards for

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automotive headlamps.

- [c91] 91. The bezel of claim 78, wherein the bezel has an UV-protective coating on the outer surface and the edge surfaces.
- [c92] 92. The bezel of claim 78, wherein the bezel has an UV-protective coating on the inner and outer surfaces and the edge surfaces.
- [c93] 93. The bezel of claim 77, wherein the photoluminescent material is an organic nanoparticle.
- [c94] 94. The bezel of claim 93, wherein the organic nano-particle comprises a fluorescent dye selected from the group consisting of perylene derivatives, anthracene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, or (2,5-bis[5-tert-butyl-2-benzoxazolyl]-thiophene) and all their derivatives.
- [c95] 95. The bezel of claim 77, wherein the photoluminescent material is an inorganic nano-particle.
- [c96] 96. A method for making or bezel having a luminescent visual effect for an automotive headlamp, comprising the steps of preparing a molding composition comprising a polycarbonate and a photoluminescent material, molding the lens or bezel from the molding composition, and optionally forming cuts or protrusions, or both, in a surface of the lens or bezel article to define the graphic image, wherein the step of forming the cuts or protrusions can occur during or subsequent to the molding step, and wherein the luminescent visual effect occurs at least at an edge of the lens or bezel and at cuts and protrusions formed therein.
- [c97] 97. The method of claim 96, wherein the photoluminescent material is an organic fluorescent dye.
- [c98] 98. The method of claim 96, wherein the photoluminescent material is an organic nano-particle comprising an organic fluorescent dye.

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99. The method of claim 96, wherein the photoluminescent material is an inorganic nano-particle.

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